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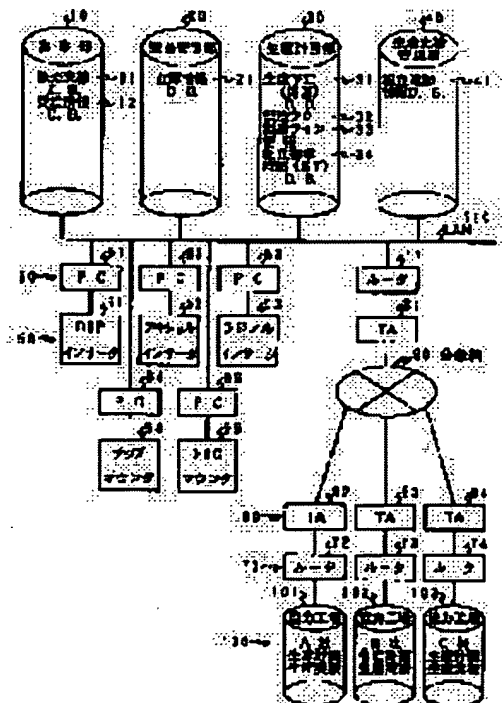
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## (54) PRODUCTION SYSTEM AND PRODUCTION SCHEDULING METHOD FOR PRINTED CIRCUIT BOARD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To realize a production system in which the production schedule can be modified easily upon request from a client by registering and managing the sales results of each product up to the present and the order information from each sales office and requesting production automatically to a production planning section when the stock decreased below the minimum level.

**SOLUTION:** Order information from each sales office is registered in the order information D. B. 12 at a sales office and the inventory information D. B. 21 at a product management section 20 is accessed immediately in order to determine the presence of the stock. The inventory is set automatically from the average sale and the increase rate of sale for the past two years determined based on the data of sales result D. B. 11. If the stock is deficient, the data of delivery is compared with the date of starting work and a production request mail for modifying the schedule to the earlier one is delivered



to a production planning section 30. This method realizes a system wherein the production schedule is averaged, a high efficiency production schedule is planned and the production schedule can be modified easily upon request from a client.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the production equipment and the production-planning planning approach which are used for the assembly of the printed circuit board used for an electrical machinery and apparatus.

[0002]

[Description of the Prior Art] Conventionally, production planning (inside, small schedule) is drawn up based on the original production schedule (large schedule). Therefore, when a scheduled production schedule is differed from according to business or an award situation at the beginning, by the time it totals and judges sales performance, actual production, etc. to current and changes them, it will take great time amount.

[0003]

[Problem(s) to be Solved by the Invention] When there was modification of production directions, for the modification arrangement of production, or the production adjustment of an after process, confusion generated the award of components, leaving-the-garage directions, production directions, communication to cooperation works, etc. in many fields, and great time amount was spent vainly.

[0004] The place which this invention is made paying attention to the above-mentioned trouble, and is made into the 1st object is to offer the production equipment of the printed circuit board which makes possible the system which gives the flexibility which can change production planning easily according to a demand of a customer, when leveling is attained to a production schedule, production planning with high productive efficiency is drawn up and a customer's award occurs.

[0005] Moreover, the place made into the 2nd object of this invention feeds back award information to the original production schedule, it enables it to judge production modification etc. promptly, not only in the company but grasp of the production progress situation of cooperation works is carried out in production modification, and it is for providing about the production-planning planning approach of a printed circuit board that production planning with a promptly high precision can be re-drawn up.

[0006]

[Means for Solving the Problem] In order to attain the 1st above-mentioned object, the production equipment of the printed circuit board concerning invention of claim 1 With the production schedule planning category which draws up a production schedule (large scheduling) based on information, such as sales performance (award information) from the past to current, a new-product-development situation, a future economic trend, a sale target, and production capacity (a staff, facility) A operating information management means to register and manage the award information which comes from the sales performance and each operating member to current [ of each product ], or each office, respectively, When the number of inventories of inventory information D.B. is less than the number of the minimum inventories, a production demand is automatically performed to a production-planning information management means. Moreover, the case where the number of the maximum inventories is exceeded by production, when [ that there is modification of the number of inventories ] there is nothing a fixed period, and when The product management information management tool which issues the directions to which reexamination of a production schedule is automatically urged to a production-planning information management means, If a product name is registered into production schedule (plan) D.B., activity manday will be calculated from the corresponding assembly allowed time (ST). Daily production planning (small scheduling) is drawn up. At this time The production demand from said product management information management tool, Or when there are production schedule reexamination directions, while small scheduling is again drawn up according to that content, and fulfilling a demand schedule in this case in the company when production is difficult and electing producible cooperation works A production-planning information management means to perform reservation of a production schedule automatically, and the assembly progress situation of a printed circuit board are managed by assembly progress information D.B. A production management-by-results

information management means to perform high management of precision by grasping track records including the progress situation of cooperation works in in the company and a list, The workstation constituted by connecting a operating information management means, a product management information management tool, a production-planning information management means, and a production management-by-results information management means through a high speed LAN, While transmitting the data of the assembly progress situation of the automatic mounting machine which carries out automatic mounting of the components at a printed wired board, and performs assembly of a printed circuit board, and each automatic mounting machine to a production management-by-results information management means The automatic mounting machine terminal which receives the production directions (instruction) of a product name, a burst size, etc. produced from a production-planning information management means, It is characterized by having the cooperation works which are connected to the production management-by-results information management means through the high speed LAN at the router, the terminal adopter, and the public list, and transmit and receive the information on production planning and actual production.

[0007] When leveling is attained to a production schedule, production planning with high productive efficiency is drawn up and a customer's award occurs by this configuration, the system which gives the flexibility which can change production planning easily according to a demand of a customer becomes possible.

[0008] In order to attain the 2nd above-mentioned object, moreover, the production-planning planning approach of the printed circuit board concerning invention of claim 2 A production schedule planning category The sales performance (award information) from the past to current, a new-product-development situation, As opposed to the production schedule (large scheduling) which drew up based on information, such as a future economic trend, a sale target, and production capacity (a staff, facility) The award situation of the printed circuit board inputted from a operating information management means (information), Various information, such as inventory information on the printed circuit board inputted from a product management information management tool, is fed back. At the same time it selects automatically the product which needs production with a production-planning information management means and performs a production demand Reexamination is urged a production schedule about a thing with a difference, and the actual production of in the company [ in this time ] and cooperation works is grasped with a production management-by-results information management means, and it is characterized by drawing up production planning with a high precision based on it.

[0009] In order to attain the 2nd above-mentioned object, moreover, the production-planning planning approach of the printed circuit board concerning invention of claim 3 In the production-planning planning approach of a printed circuit board according to claim 2 a product management information management tool When the number of inventories of inventory information D.B. is less than the number of the minimum inventories, a production demand is automatically performed to a production-planning information management means. Moreover, when exceeding the number of the maximum inventories by production, or when [ that there was modification of the number of inventories ] there was nothing a fixed period, the directions to which reexamination of a production schedule is automatically urged to a production-planning information management means were issued.

[0010] Moreover, in the production-planning planning approach of a printed circuit board according to claim 2, in order to attain the 2nd above-mentioned object, the production-planning planning approach of the printed circuit board concerning invention of claim 4 was made to carry out high management of precision, when said production management-by-results information management means grasped track records including the progress situation of cooperation works in in the company and a list.

[0011] In order to attain the 2nd above-mentioned object, moreover, the production-planning planning approach of the printed circuit board concerning invention of claim 5 In the production-planning planning approach of a printed circuit board according to claim 2, if a production-planning information management means registers a product name into production schedule (plan) D.B. Calculate activity manday from the corresponding assembly allowed time (ST), and daily production planning (small scheduling) is drawn up. When there is a production demand from said product management

information management tool or production schedule reexamination directions at this time According to that content, small scheduling was drawn up again, and while the demand schedule was fulfilled in the company when production was difficult, and electing producible cooperation works in this case, it was made to perform reservation of a production schedule automatically.

[0012] Therefore, according to the production-planning planning approach of the printed circuit board of this invention, the production schedule which drew up in the production schedule planning category carries out automatic setting of the activity start date which will start production from the delivery date day of a product if it registers with production schedule D.B of a production-planning information management means, and production planning which activity manday equalizes is drawn up. Moreover, if the award information on a product (a product name of article, the number of awards, etc.) is inputted from each office, the inventory information on a product will be retrieved, it leaving-the-garage-directs about a thing with an inventory, and about what is not, a production demand is automatically outputted to the production-planning section, and re-planning of production planning is performed. At this time, at present, in the company, and external (cooperation works) assembly progress information is grasped, and production planning with a high precision is drawn up automatically.

[0013] For this reason, change of the needs to a production schedule is reflected promptly to production planning, and when the confusion generated between each section and between each post is lost, the lead time from an award to delivery can be shortened. Moreover, since it is a simple configuration, mistakes, defects, etc. who are generated at a process the middle are reducible.

[0014]

[Embodiment of the Invention] Hereafter, this invention is explained with reference to a drawing.

[0015] Structure-of-a-system drawing and drawing 2 which show one example of the production equipment of the printed circuit board concerning this invention in drawing 1 are a flow chart which shows the procedure of the production-planning planning approach of the printed circuit board concerning this invention.

[0016] In drawing 1, 10 is a marketing department as a operating information management means, the sales performance by the present of each product is sales performance D.B.11, and the award information which comes from each operating member or each office is registered and managed by award information D.B.12, respectively.

[0017] 20 is the product Management Department as a product management information management tool, and inventory stock status is managed by inventory information D.B.21.

[0018] 30 -- the production-planning section as a production-planning information management means - - it is -- a production schedule (large scheduling) -- production schedule (plan) D.B.31 -- the facility information on each production line is registered into assembly (allowed-time ST) D.B. for each production process of each product to the production-line information 33 at the manufacture flow 32, and the assembly allowed time of each product is managed.

[0019] 40 is the production management-by-results section as a production management-by-results information management means, and has managed the assembly progress situation of a printed circuit board by assembly progress information D.B.41.

[0020] It connects through a high speed LAN 110, and the above-mentioned marketing department 10, the product Management Department 20, the production-planning section 30, and the production management-by-results section 40 consist of workstations etc.

[0021] 50 is an automatic mounting machine (in the company), carries out automatic mounting of the components at a printed wired board, and performs assembly of a printed circuit board.

[0022] The automatic mounting machine 50 consists of the DIP inserter 51, the axial inserter 52, a radial inserter 53, a chip mounter 54, and an FIC mounter 55.

[0023] 60 is a terminal for automatic mounting machines, and it connects with the production-planning section 30 and the production management-by-results section 40 through a high speed LAN 110, and it consists of personal computers etc.

[0024] The terminal 60 for automatic mounting machines consists of 61 for DIP inserters, 62 for axial inserters, 63 for radial inserters, 64 for chip mounters, and 65 for FIC mounters, and transmits the data

of the assembly progress situation of each mounting machine to the production management-by-results section 40. Moreover, the production directions (instruction) of a product name, a burst size, etc. produced from the production-planning section 30 are received.

[0025] 100 is cooperation works (external), and a router 70, TA (terminal adopter)80, the public 90, and a list are resembled, it connects with the production management-by-results section 40 through the high speed LAN 110, and it transmits and receives the information on production planning and actual production.

[0026] Next, the production equipment of the printed circuit board of this example constituted as mentioned above is explained with reference to the flow chart shown in drawing 2.

[0027] Drawing 2 is the flow chart of the processing program of the production-planning planning approach of the printed circuit board performed by a marketing department 10, the product Management Department 20, the production-planning section 30, the production management-by-results section 40, the terminal 60 for automatic mounting machines, and the cooperation works 100.

[0028] In drawing 2, the production schedule for half a year thru/or one year is drawn up by the production-planning planning category (step S1). The drawn-up production schedule is registered into production schedule (plan) D.B.31 of the production-planning section 30 (step S2). The information registered at this time is information, such as a product name, a burst size (number), and a delivery date day.

[0029] and the product from up Norio -- final-assembly time amount (gross-product activity manday) is searched for the product name of schedule (plan) D.B.31 from assembly (allowed-time ST) D.B.34 to a key, and the preliminary decision of the activity start date is carried out by the degree type (step 3).  
activity start date = delivery date day-DD=(final-assembly time amount x burst size)/KK: -- the activity manday per day / the number of \*\* No. per day [0030] It registers with production schedule (plan) D.B.31 of the activity start date which carried out the preliminary decision.

[0031] Next, Chunichi computes the gross-product activity manday for one month as a plan to every month of an activity start date (step 4). The gross-product activity manday for this every month is compared with the average activity manday per [ which was deduced from the production schedule ] moon, and when that difference is \*\*5% or more (step 5), in order to equalize activity manday, modification of a delivery date day is directed (step 6). At this time, when modification of a delivery date day is difficult, the directions (overtime, a staff's enhancement, a facility, cooperation works reservation, etc.) which raise production capacity are issued (step 7). Daily production planning (small scheduling) is drawn up using the known "PERT technique" before one week of activities (step 8).

[0032] At this time, assembly progress information D.B.41 are accessed, the number of inventories is checked in the progress degree and list to a schedule, and a plan is drawn up (step 9). If the number of inventories is seasoned with a burst size, when exceeding the upper limit of the number of inventories, or when there is no award and there is no modification of the number of inventories for three months, directions of the production last check are issued.

[0033] Assembly progress information D.B.41 of the production management-by-results section 40 carry out automatic access at actual production D.B[ of 1 time (night) per day, and each cooperation works ], and perform renewal of progress information automatically. The next processing is performed when a difference with the average activity manday on the 1st exceeds \*\*5% at this time (step 10). - When it is 5% or less (step 11), include a worked part in a schedule on the next day (step 12), when it is +5% or more, access the production-line information 33 on the production-planning section 30, and choose cooperation works with the facility (line) which can manufacture a product (step 13).

[0034] If in charge of an assembly schedule, it checks whether the activity manday of each process of the product for which accesses with production planning of each cooperation works 100, and it depends through a high speed LAN 110, a router 70, TA80, and the public 90 is securable (step 14). When it reserves when securable, and it cannot secure, it accesses with other cooperation works and the same check is repeated (step 15). When every cooperation works are impossible, re-planning of production planning is outputted to a screen with examination directions of modification of a production schedule, production schedule control of cooperation works, etc. (step 16). The workmanship instruction for

which it opted is displayed on the terminal 60 for automatic mounting machines.

[0035] During the above-mentioned production-planning planning, since sale operation is also performed simultaneously, the following interrupt processing is performed.

[0036] Award information is registered from each office award information D.B.12 of a marketing department 10 (step 17). The data format of this award information consists of a customer name, a product name, a format, the number, and a delivery date. Award information D.B.12 are made to carry out automatic generating of the number at the order of registration at the time of registration, and award information accesses promptly inventory information D.B.21 of the product Management Department 20, and searches the existence of an inventory at the same time it sets up \*\*\*\* of the pilot number, and the item number which is a number for every product (step 18). At this time, leaving-the-garage reservation (directions) is carried out about a thing (step 19) with a several award minutes inventory (step 20).

[0037] Next, it checks whether the number of inventories is less than the quantity set up beforehand for leaving-the-garage directions (step 21). Automatic setting of the setting out of the number of inventories is carried out based on the data of sales performance D.B.11 from the average sales quantity and the sales quantity rate of increase for the past two years.

[0038] Whether when the number of inventories is less, it registers with the production schedule checks (step 21), and when registered, the production demand mail which compares a delivery date day and an activity start date, and is changed into the schedule of the earlier one is transmitted to the production-planning section 30 (step 23).

[0039] Next, when there is no several award minutes inventory, on the delivery date day which a customer demands, delivery is possible or it judges by performing simulation based on production-planning data (step 24). When it can supply, the production demand mail in the delivery date day of a simulation result and an activity start date is transmitted to the production-planning section 30 (step 25). The day which can be supplied is answered when it cannot supply on the delivery date day which a customer demands (step 26). An alternate product is introduced when the day which can be supplied is dissatisfied (step 27).

[0040]

[Effect of the Invention] When according to the production equipment of the printed circuit board concerning this invention leveling is attained to a production schedule, production planning with high productive efficiency is drawn up and a customer's award occurs so that clearly from the above explanation, the system which gives the flexibility which can change production planning easily according to a demand of a customer becomes possible.

[0041] Moreover, according to the production-planning planning approach of the printed circuit board concerning this invention, the production schedule which drew up in the production schedule planning category carries out automatic setting of the activity start date which will start production from the delivery date day of a product if it registers with production schedule D.B of a production-planning information management means, and production planning which activity manday equalizes is drawn up. Moreover, if the award information on a product (a product name of article, the number of awards, etc.) is inputted from each office, the inventory information on a product will be retrieved, it leaving-the-garage-directs about a thing with an inventory, and about what is not, a production demand is automatically outputted to a production-planning information management means, and re-planning of production planning is performed. At this time, the assembly progress information on in the company [ in this time ] and cooperation works is grasped, and production planning with a high precision is drawn up automatically.

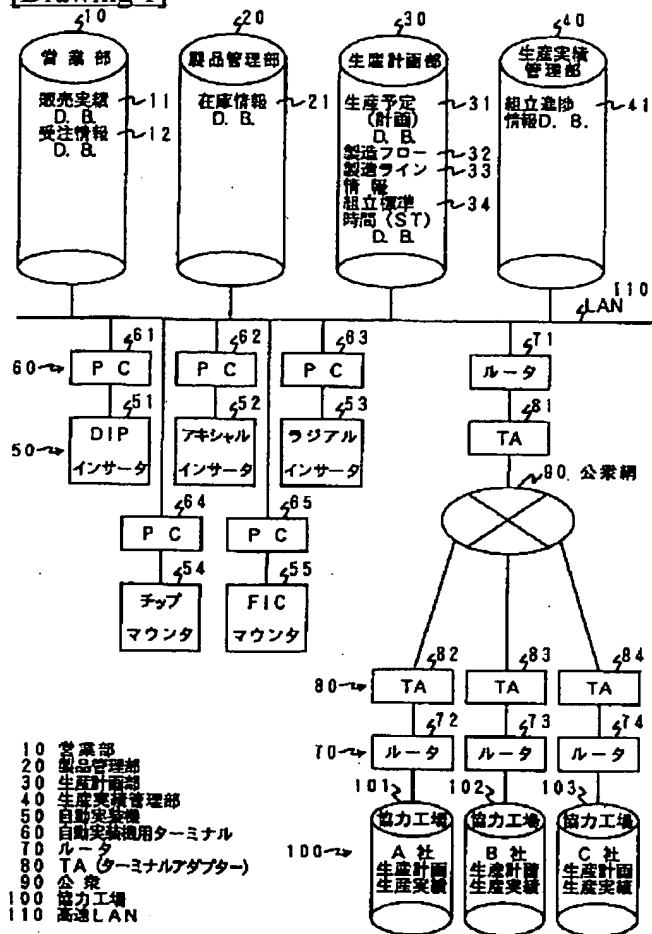
[0042] For this reason, change of the needs to a production schedule is reflected promptly to production planning, and when the confusion generated between each section and between each post is lost, the lead time from an award to delivery can be shortened. Moreover, since it is a simple configuration, mistakes, defects, etc. who are generated at a process the middle are reducible.

[Translation done.]

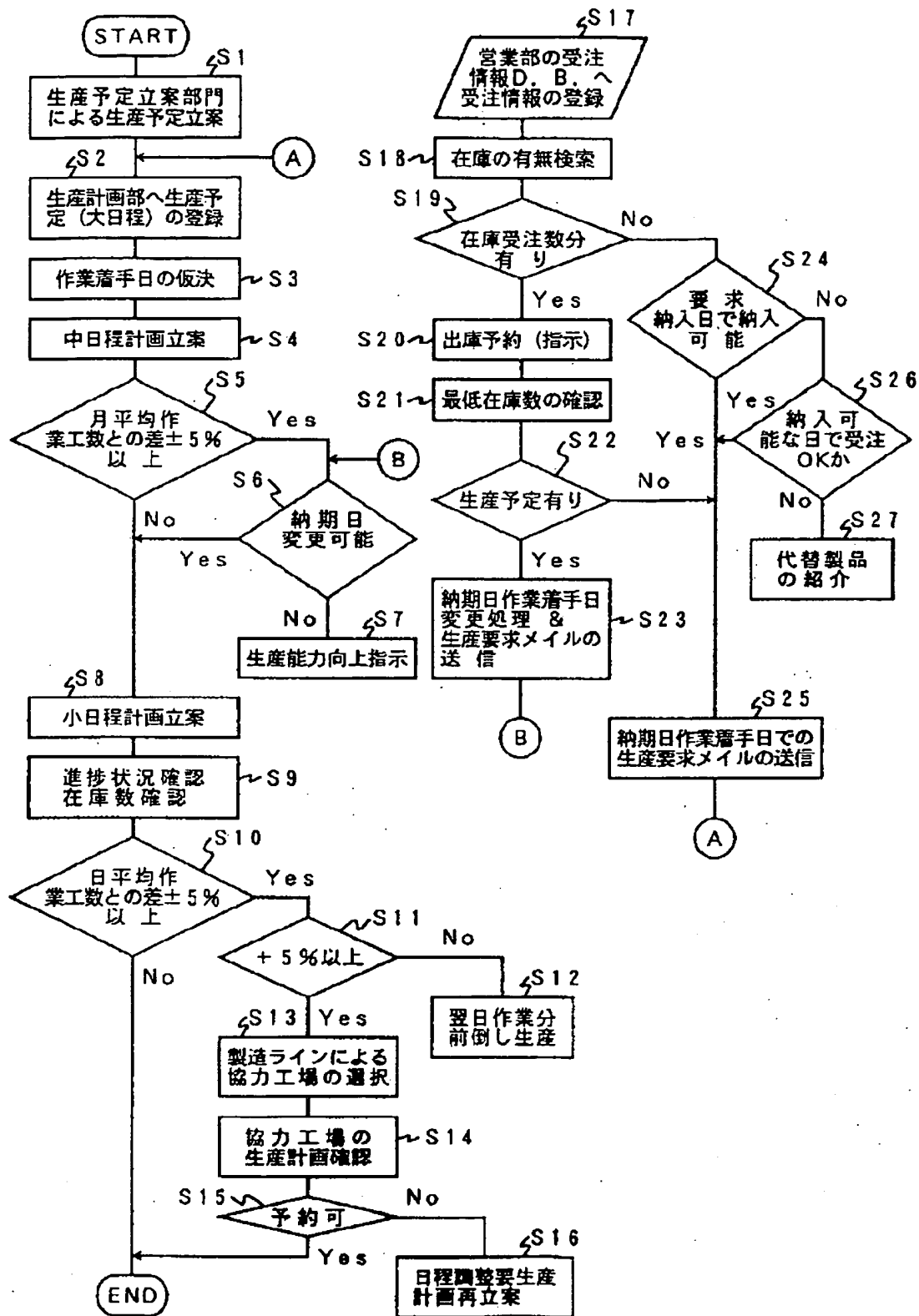


# DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]